

the *Citrus Industry*



HAROLD MOWRY
Director of the Florida Experiment Station

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World, National and State Citrus Production Sets All-Time Record

World production of citrus fruits in 1945-46 is the largest on record, according to the United States Department of Agriculture's Office of Foreign Agricultural Relations.

The citrus output in 36 major producing countries in 1945-46 is estimated at 335 million boxes, compared with 320 million the year before, and an average of 266 million in the 1935-39 period. Of the current season's prospective citrus production, 243 million boxes are oranges, tangerines and mandarins, 66 million boxes are grapefruit, and 26 million boxes are lemons.

Orange production, reaching a record high level, exceeded the pre-war average of 198 million boxes by 17 percent, with output continuing to expand in the United States, Mexico, French Morocco and the Union of South Africa. The North American, Central American and West Indian production for 1945-46 is forecast at 121 million boxes, which is a million less than the previous year, but 61 percent more than the pre-war average.

World production of lemons has remained fairly constant for several years at around 25 million boxes. The output for 1945-46 outside the United States decreased 20 percent, but rose 45 percent in

this country. Nearly all the world's grapefruit is grown in the United States, principally in Florida, Texas, and Arizona.

United States Production

The United States Department of Agriculture estimates the production of all citrus fruits in the United States for the 1945-46 season at about 187,000,000 boxes, a new high record.

This estimate is 5 per cent above production last season and 50 per cent above the 10 year (1934-43) average.

The orange crop was placed at 106,320,000 boxes compared with

109,010,000 last season and with 73,725,000 for the 10-year average. Production this season by states included:

California, 50,100,000; Florida, 50,000,000; Texas, 4,700,000; Arizona, 1,210,000 and Louisiana, 310,000.

The grapefruit crop was estimated at 62,830,000 boxes compared with 52,130,000 last season and with 37,000,000 for the 10-year average.

Production by states included: Florida, 32,000,000; Texas, 23,000,000; Arizona, 4,300,000 and California, 3,530,000.

The Florida tangerine crop was estimated at 4,000,000 boxes compared with 4,000,000 last season and with 2,780,000 for the 10-year average.

The California lemon crop was
(Continued on page 14)

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Trends In Costs And Returns Of Florida Citrus

Florida production of oranges, grapefruit, and tangerines was 24,900,000 boxes in 1931-32, the first season of our citrus cost of production study. In 1944-45 our production was 70,500,000 boxes, or an increase of 183 percent over the former season. During this same interval of 13 years the United States production increased 149 percent and the world production 67 percent. The increase in orange and tangerine production in Florida was 234 percent, with the rate of increase in the United States slightly over one-half and the world rate of increase about one-fifth that of Florida. Florida grapefruit production increased 116 percent while the rate of increase for the United States and the world was approximately twice that of Florida.

Trend in Citrus Yields

Citrus groves on which the Agricultural Extension Service has records vary as to the kind of citrus grown. This variation is from 100 percent orange groves to 100 percent grapefruit groves, but a grove that has 71 percent tangerine trees is the highest proportion we have of that kind of citrus. There are almost as many different combinations of the three kinds of citrus as there are different groves represented in our records. The average grove over this period was made up of 32 percent grapefruit, 4 percent

ZACH SAVAGE

Extension Agricultural Economist,

Presented at Meeting of Citrus Production District Association, in Orlando, Jan. 29

tangerine, and 64 percent orange trees.

We have records on groves for each season since the work began in 1931. The number of seasons that we have records on each grove varies from one to 13. The average number of grove records for groves averaging over 10 years of age was 219 per season. These groves are located throughout the citrus area with the majority of them in Lake, Orange, Polk, and Highlands counties.

While our total production of citrus has been increasing in Florida due to various reasons, the number of boxes of fruit harvested from these groves has been increasing. (Chart 1) The boxes of fruit harvested for the first seven seasons averaged 132, while the average for the past six seasons was 222 boxes, or an increase of 68 percent. The average age for the two periods was 18 and 21 years respectively. After eliminating the effects of the increase in age, production still in-

creased 46 percent. Good fruit prices during recent seasons have resulted in a higher percentage of the fruit being harvested which accounts for some of the increase in fruit harvested per acre. Many other factors might be mentioned that have contributed to this increase.

Costs and Returns

The trend in the cost per acre to produce citrus has been upward for the past 3 seasons. (Chart 1) The increase was 68 percent between the 11-year period 1931-42 and the 3-year period 1942-45. The major portion of this increase has been due to the increase in labor costs and the use of more fertilizer.

The increase during recent seasons in fruit returns to the grower has been at a more rapid rate than the increase in cost. The increase per acre between the 7-year period 1931-38 and the 6-year period 1938-44 was 132 percent, whereas the increase between the first 10 years of the records and the past 3 seasons was 222 percent.

The price the grower received for this fruit was \$.75 and \$1.04, respectively, for the 7- and the 1-year periods, or a 39 percent increase. (Chart II) The increase in price received for fruit and the increase in fruit harvested per acre are the main factors in the increase in returns per acre, two favorable fac-

tors very rarely experienced by the citrus grower at the same time.

The increase in the number of boxes of fruit harvested per acre

was 121. Since that time the trend has been upward until the value was 7 points higher in 1945 than in 1920.

TABLE 1.—Comparison of costs and returns per acre between two 7-year periods, 1931-38 and 1938-45*.

| | 1931-38 Average | 1938-45 Average | Pctage. Change |
|----------------------------|--------------------|--------------------|-------------------|
| Average Age | 18 | 21 | 17 |
| Labor, power and equipment | \$22.33 | \$ 30.69 | 37 |
| Fertilizer and amendments | 23.51 | 30.26 | 29 |
| Spray and dust materials | 3.61 | 6.39 | 77 |
| State and county taxes | 6.16 | 4.40 | -29 |
| Miscellaneous | 1.48 | 3.82 | 158 |
| Total costs | 57.09 | 75.56 | 32 |
| Fruit returns | 99.23 | 230.46* | 132 |
| Net | 42.14 | 154.90 | 268 |

*Only 6 seasons represented in fruit returns.

TABLE II.—Comparison of costs and returns per box between the two periods 1931-38 and 1938-44.

| | 1931-38 Average | 1938-44 Average | Pctage. Change |
|----------------------------|--------------------|--------------------|-------------------|
| Labor, power and equipment | \$.17 | \$.12 | -29 |
| Fertilizer and amendments | .18 | .12 | -33 |
| Spray and dust materials | .03 | .03 | |
| State and county taxes | .04 | .02 | -50 |
| Miscellaneous | .01 | .02 | 100 |
| Total costs | .43 | .31 | -28 |
| Fruit returns | .75 | 1.04 | 39 |
| Net | .32 | .73 | 128 |

was more than enough to offset the increase in costs and resulted in lowering the cost of production per box between the two periods 1931-38 and 1938-44. (Table II).

Grove Values

In general, the income derived from a business or piece of property is reflected in the sale value of that business or property. This is also true in the case of citrus groves. However, it is also true that the same relationship is not maintained year after year between the income and the sale value of that property. Chart III shows the trends between the index of the income per grove and the index of the per-acre value of citrus groves sold in Lake County, Florida. Between 1941 and 1944 the value of citrus property sold doubled in that county while the returns above operating costs per grove increased 7 times in the state.

This trend during 4 years of the war period might be expected to change with the changing conditions following the war period. For an indication of this we might observe the trends of Florida farm real estate values during and following World War I. (Chart IV). The increase in value was not quite so great from 1935 to 1945 as it was from 1910 to 1920 but the trend has been very similar.

The trend of United States farm real estate values was sharply downward following World War I and Florida values started downward until checked by the boom in 1923 and went upward to an index of 223 in 1926. From this height the trend was downward rather rapidly until 1933 when it

Income Per Grove

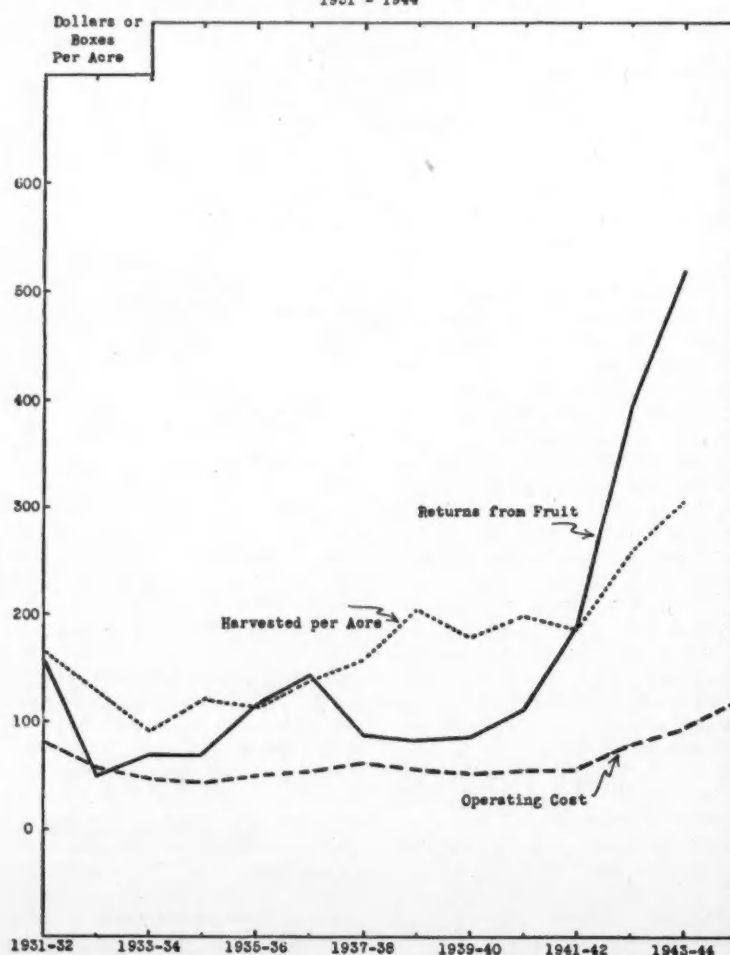
The income of industrial workers in the United States increased approximately 200 percent from 1940 to 1944. (Chart V) During this same period the net operating income per grove increased 800 percent. The trend in these two lines was in the same direction each year from 1931 to 1944 with the exception of the one season of 1937 when the income of industrial workers increased and grove income decreased.

Income and Debt Load of Citrus Groves

There have been numbers of groves changing hands during recent years. Some of these have been paid for in cash. Others have been financed in various ways with the purchaser's equity in the grove also varying greatly. Some of the

CHART I

COSTS, RETURNS, AND FRUIT HARVESTED PER ACRE
FLORIDA CITRUS GROVES OVER 10 YEARS OF AGE
1931 - 1944



groves changing hands recently at prices much higher than a few years ago now have a debt larger than their full market value a few years ago. A current debt of 53 percent or more of present average price of groves changing hands in Lake

per acre over the past 13 years (Table III). To pay the principal and interest payment on both a 20-year loan of \$300 at 4 percent and a production loan of \$65 for 12 months at 5 percent would require a payment of \$95. A production loan

of \$65 per acre was used here since it approximates the average cost of production during the past 13 years of \$62. This would leave the owner only \$3 per acre or \$77 from the entire average grove of 33 acres. At this rate a very large grove acreage would be necessary to supply sufficient income to support the owner over and above this debt load. With no debt the average grove of 33 acres returned \$3,320 to its owner.

During the 10-year pre-war period of 1931-41 this average grove returned \$1,317 to its owner for his living and any debt payment he may have had. Such an income would not make a debt payment of much size and at the same time furnish a living to the owner.

(Continued on page 12)

CHART II

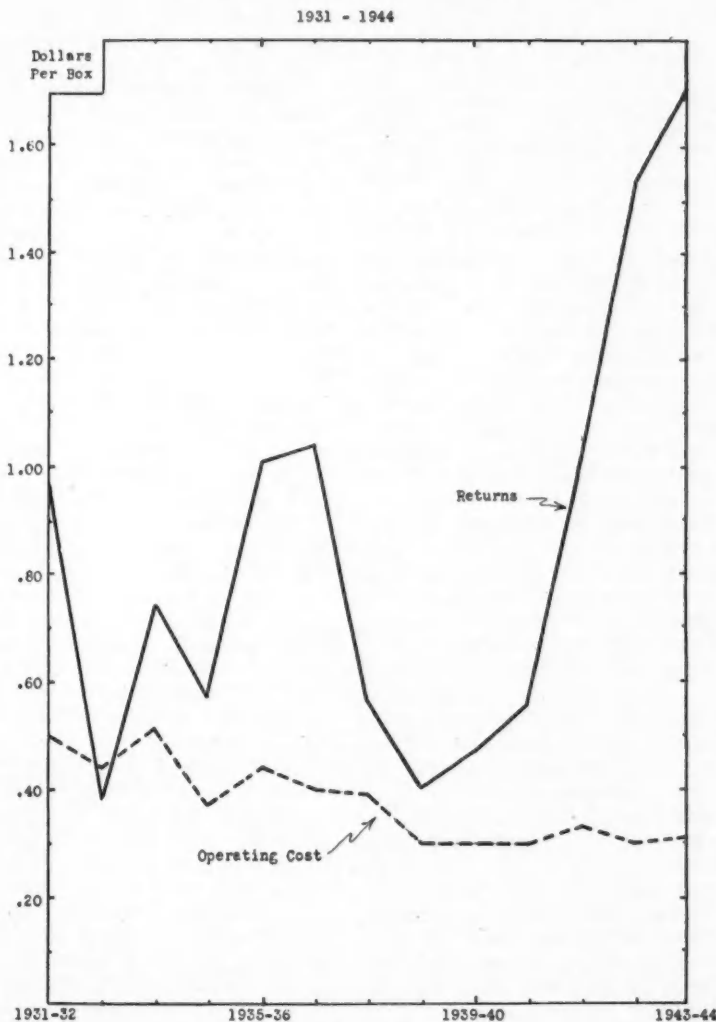
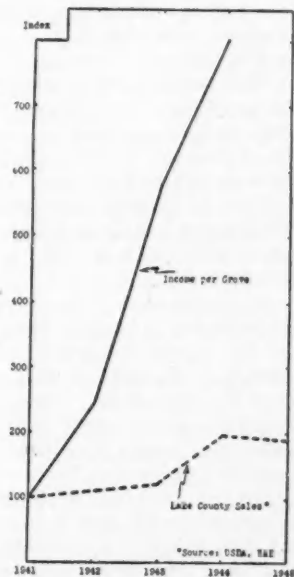
COSTS AND RETURNS PER BOX
FLORIDA CITRUS GROVES OVER 10 YEARS OF AGE

CHART III

FLORIDA GROVE INCOME AND
PRICE PER ACRE OF GROVE SALES IN LAKE COUNTY
INDEX NUMBERS (1941 = 100)

County would equal or exceed average prices prevailing in 1941. To have 50 percent equity in a citrus grove and obtain a loan on the remaining 50 percent may not be out of the ordinary provided the value of the grove is conservative. But to obtain a larger loan than the entire value of the grove was a few years previous would place the borrower in a bad position should the grove value decline drastically before the debt was paid off, or substantially paid off.

The net income from groves included in our records averaged \$98

TABLE III. — Income and debt load of citrus groves.

| | 1931-44 13-Year Average | 1931-41 10-Year Average | 1941-44 3-Year Average |
|--|-------------------------------|-------------------------------|------------------------------|
| Acreage | 7473 | 7132 | 8609 |
| Fruit harvested per acre | 173 | 150 | 250 |
| Returns per box | \$.92 | \$.65 | \$1.47 |
| Net returns per grove (33 acres) | 3320 | 1317 | 9562 |
| Per Acre: | | | |
| Production cost | 62 | 57 | 79 |
| Fruit returns | 160 | 97 | 368 |
| Net | 98 | 40 | 290 |
| Principal and interest payment on 20-year loan of \$300 at 4 per cent | 27 | 27 | 27 |
| Net | 71 | 13 | 263 |
| Production loan of \$65 at 5 per cent | 68 | 68 | 68 |
| Net both loans | 3 | —55 | 195 |
| Net production loan only | 30 | —28 | 222 |
| Per Grove: | | | |
| Net both loans | 77 | —1826 | 6418 |
| Net 20-year loan | 2329 | 426 | 8671 |
| Net production loan | 968 | —935 | 7310 |
| Per Acre: | | | |
| Maximum production loan at 5 per cent | 93 | 38 | 276 |
| Maximum 20-year loan at 4 per cent | 1084 | 444 | 3219 |

Some Additional Information On Citrus Psorosis

Three years ago I presented a paper before this Society on the Identification of Psorosis in the Citrus Nursery (2). The history, characteristics, nature, and cause of the disease were briefly discussed, and certain suggestions were made for its control, especially in the citrus nurseries. It was pointed out then that there is little hope for a cure of infected trees or a practical method of control for the disease in bearing groves and, because it has its origin or starting point in the nursery, psorosis control is largely the nurseryman's problem. Since it is distributed from nurseries to new grove locations where the disease is not readily detected until bark symptoms appear 12 to 15 years later, when nothing can be done to control it, the first line of defense against the spread of this trouble should begin at the nursery. This same line of reasoning holds true today. It was also pointed out that the disease is of virus origin, and the only known method of spreading it is by budding and grafting, thus making man himself the most active agent in spreading psorosis throughout the State.

Our conclusions then were that if budwood is taken from trees that are known to be absolutely free from psorosis (and I wish to underscore the phrase "known to be absolutely free") and if buds from such wood are placed in young, healthy citrus stocks that had never been previously budded, the resulting nursery trees will be absolutely free from psorosis and there will be no possibility of spreading this disease from any nursery taking such precautions.

It was also suggested that by frequent inspection of young growing nursery plants after the buds had sprouted and were making foliage growth, infected plants could be detected by definite leaf symptoms appearing in the young leaves at certain stages in their growth. This method was suggested for use in nurseries where the budwood was doubtful or of unknown history. While leaf symptoms are dependable and afford a quick test of the early presence of psorosis in

H. E. STEPHENS

Senior Pathologist, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry Soils and Agricultural Engineering, Agricultural Research Administration, United States Department of Agriculture—at meeting of Florida State Horticultural Society.

infected plants, their elusive habit of appearing and later disappearing as the growth matures, has probably discouraged the general use of such a test in the nursery. Most of the information and suggestions made three years ago will hold true at the present time.

Studies of the disease have been continued through testing of infected buds and by transmission of the disease by infected buds. Considerable attention has been given to leaf symptoms, especially as an aid in identifying psorosis and following its progress in infected trees. Buds from various healthy citrus varieties have been infected and the character of the symptoms noted. No variety yet tested has shown definite immunity to leaf symptoms. Several new facts and angles have been uncovered in recent studies which may be used to advantage in preventing the future spread of this disease.

Symptoms of Psorosis

There are two types of symptoms by which psorosis can be recognized and distinguished from other citrus diseases. They are bark symptoms, known for a long time, and which are more easily and generally recognized by the growers; and leaf symptoms, which come to our knowledge in more recent years.

Bark symptoms. Typical bark lesions have been associated with psorosis from its earliest history in the state. They were observed by Swingle and Webber (3) previous to the freeze of 1894 and 1895. These symptoms appear as bands of scaly or roughened bark encircling the larger branches and trunks of infected trees. These bands never disappear but continue to spread upward and downward as

long as the tree is alive. The affected areas are first covered with small, thin flakes of bark that gradually weather off, leaving a roughened, irregular surface of new bark formed in the progress of the disease. Droplets of gum frequently appear at the advancing edges of these areas, but it is never in a copious flow as in the case of gummosis or foot rot. Bark lesions may occur on smaller twigs less than an inch in diameter and gradually spread to larger branches. Bark symptoms are slow in development and may not appear on infected trees until they are 12 to 15 years of age or older and have come into bearing. The earliest record we have on the development of bark symptoms is Fawcett's work in California (1) where bark symptoms appeared on budded trees 8 to 10 years after budding. Instances have been noted in Florida groves where bark symptoms were distinctly evident on trees that were supposed to have been budded nine years before. There is probably considerable variation in individual trees and perhaps in the different varieties as to the time infected trees will develop the bark symptoms. Some trees may carry the disease in a latent form and never show bark symptoms, still they would be potential sources of spreading the trouble if used to supply budwood for new trees.

Bark symptoms develop slowly after they appear, and it may take several years before the tree is in its final stages of decline. Such trees continue to produce some fruit but the production becomes less each year, until the tree is not worth keeping longer. Trees showing bark symptoms are apparently more subject to cold injury, and many are killed or badly injured by low temperatures in their later stages of decline. In the larger and older areas of infected bark other diseases may enter and cause a more rapid killing back of affected branches. As I have stated before, a diseased tree is a lost tree, and very little can be done to cure the disease or prolong the life of such a tree if psorosis has become

thoroughly established throughout its system, which is evidently the case when bark symptoms are present.

Leaf symptoms. By means of leaf symptoms the presence of psorosis can be detected in any infected citrus tree or young citrus plant.

Most virus diseases produce certain definite markings or patterns in the foliage of infected plants by which the disease can usually be identified at a glance. The psorosis virus also produces a pattern on citrus leaves at a certain stage in their growth. Thus leaf symptoms make it possible, in a very short time, to detect the presence of psorosis in infected citrus trees that have not shown bark symptoms, and also make it possible six to eight weeks after buds are inserted to determine whether or not nursery plants carry the disease. Instead of waiting for 10 to 20 years for bark symptoms to appear, the use of leaf symptoms has made available a method for determining whether or not young plants carry psorosis, before they leave the nursery rows. By this method psorosis infected nursery plants can be identified and destroyed instead of finding their way into grove plantings.

Leaf symptoms appear as a mosaic-like effect on the younger citrus leaves of new growing shoots. The symptoms are more pronounced on leaves that have expanded to about one half or three fourths of their normal size. In very young leaves the pattern is indistinct, and affected leaves lose this pattern entirely after they have fully expanded and matured. Thus it is necessary to examine leaves in the proper stage of growth and from different shoots over the tree, as all leaves and shoots may not show infections at the same time. If psorosis is present in the shoot, the leaf symptoms are distinct and characteristic, and by a little practice they can easily be detected by holding the leaf toward the sun, and viewing it by transmitted light.

The mosaic-like pattern or marking on the infected leaves is made up of numerous light colored, elongated areas usually in the region of the smallest veinlets of the leaf blade. In typical cases the white or colorless markings stand out in sharp contrast against the normal green color of the leaf. In very young leaves, before the pattern has formed, the larger veins appear colorless, followed later by a

distinct mosaic pattern made up of small light colored dots or rod shaped areas. As the infected leaf becomes mature, the light colored areas in the pattern disappear, and the leaf takes on a normal green color. In this stage such leaves can not be distinguished from normal healthy leaves. This habit of changing from an infected appearance to an apparently healthy, normal leaf in a few days' time, is one of the elusive features of the disease and one that might lead to false conclusions. If the nurseryman finds infected leaves on his trees, and two weeks later finds those same leaves have changed to apparently healthy ones, he may assume that the disease has naturally disappeared or that his trees "have grown out of it". But this is not the case by any means. Buds taken from shoots bearing infected leaves, or buds from any nursery tree that has borne infected leaves, carry the virus of psorosis and will transmit it to any other plant or stock in which such buds are placed if contact growth is established between the bud and stock. This has been demonstrated on numerous occasions. While leaf symptoms afford a valuable aid and a quick method of recognizing citrus psorosis, their use is confined to somewhat narrow limits. Growth conditions must be right before they can be definitely observed, and frequent inspections of that same growth should be made while it is in the developing stage.

Bud Transmission

It has been known for some time that psorosis could be transmitted by budding, and since it is of virus origin, this method has resulted in the widespread distribution of the disease throughout the citrus growing regions in the State. Since propagation by budding is and has been the general practice in citrus culture, it has also been the means of perpetuating the disease in a latent form for a great many years. It will continue to do so unless more attention is paid to the source of buds that are used and the condition of stocks into which these buds are inserted. Both should be of healthy origin and the budwood should come from tested trees proven to be free from psorosis. The same holds true for grafting or any other system of vegetative citrus propagation. If virus infected wood is used as scions the disease is certain to appear in any result-

ing growth from such wood.

As an illustration of how psorosis can be progressively spread over a period of years involving successive groves, I have selected three different plantings which illustrate this point. In this particular case one variety, Parson Brown, is represented, and the distribution has taken place within the past fifty years. The same condition could happen with any other variety. The groves are designated A, B, and C. and a diagram (chart 1) is included, showing the psorosis infected trees in relation to the healthy trees in groves B and C. Grove A is the parent grove from which budwood was taken for the propagation of grove B, and grove B supplied the budwood for grove C.

Grove A is an old grove, one of the early Parson Brown groves established in the State, and was severely injured by the freeze of 1894-95. It was brought back into production, and the grove today contains large bearing trees varying in age from 25 to 50 years. A brief inspection was made of grove A in 1942. The definite cases of bark symptoms were found on one old tree and on one replant, probably 25 to 35 years old. The older affected tree was in the last stages of decline and practically dead. No leaf symptoms were observed on any of the old trees at this time. With the exception of the two trees mentioned the remainder of the grove appeared to be in very good condition.

Budwood for grove B was obtained from this old grove several years ago. Trees in grove B were inspected for psorosis in April, 1942. The trees were probably 4 or 5 years old at that time and were just coming into bearing. No bark symptoms were found but leaf symptoms of the disease were quite

(Continued on page 15)

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The Citrus Industry

with which is merged The Citrus Leaf

Exclusive publication of the Citrus Growers and Shippers

Publication Office 550 North Broadway, Bartow, Florida
Telephone 269

Published Monthly By
ASSOCIATED PUBLICATIONS CORPORATION
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S. LLOYD FRISBIE Sec.-Treas.-General Manager
LOYAL FRISBIE Business Manager
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Subscription, \$1.00 per year in advance
Outside Continental United States, \$2.00 in advance

TWO HOPES

The Citrus Industry sincerely hopes that every reader of this magazine read and pondered the article by Dr. J. L. Heid entitled "How Many Oranges and Grapefruit are Too Many?" which was printed in last month's issue of the magazine. If any reader failed to do so, we hope that he will dig up the February issue and read it now.

Pointing out that the total crop of oranges and grapefruit in the United States is equivalent to less than two ounces of juice per person per day, while the minimum requirement for optimum health is six ounces, he contends that instead of having a surplus production we have in fact a shortage. The vital need of the industry, he contends, is to impress upon the minds of the public the imperative need of increased citrus consumption for the health's sake.

Then he goes on to point out that we have been too prone to compete against ourselves—one citrus producing area, one particular variety of orange or grapefruit against another—instead of concentrating our competition against other foods and food products. On this feature he says:

"In marketing our citrus crops, the growers of Arizona, California, Florida, and Texas share a common problem of disposing of the entire crops from all producing areas at a reasonable return to growers, shippers and processors. It makes little difference in the overall situation just what fruit goes to any specific market, or what channels of distribution are employed. The vital necessity of every grower in every area is that all the fruit from every producing area is totally and profitably marketed each season if a stable price structure is to be attained. Failure to profitably market all the fruit from any one area will unfavorably influence, and may demoralize, the marketing of crops from all the others."

Again he says:

"Competing deficient foods have been active in the field of exploiting specific advantages. Citrus has been comparatively inactive in this field. Perhaps the citrus industry might advantageously seek federal and state research on human nutrition more nearly commensurate with the skill which has been expended upon studying, and disseminating information upon the food requirements of sheep, cattle, horses,

mules and hogs. Man, the end product of this research and education is in need of a little attention of his own."

Certainly the points made by Dr. Heid in his article are well taken and are worthy of the careful consideration of every citrus grower, not alone in Florida but in every citrus producing section of the land. Again we express the hope that if any reader of this publication has overlooked it that he dig up last month's issue of the magazine and read it now.

Our Second Hope

In this issue of the magazine appears an article by Zach Savage, Director of Agricultural Economics at the Florida College of Agriculture, giving the results of studies carried on by his department over a period of years covering the average costs of production and the average per acre and per box on tree prices received by growers.

This article, supplementing as it does several previous articles by the same author on the same general subject which have been published in this magazine, is worthy of the careful perusal and deep consideration of every citrus grower. We commend it to the consideration of every reader of this publication. It should serve as the basis for comparison with the costs and profits of his own grove holdings.

BRIGHT OUTLOOK

Reports from citrus groves in every section of the Florida "citrus belt" indicate one of the heaviest early blooms in recent years. February rains, ranging from light to extremely heavy, together with favorable temperature conditions, have resulted in putting the trees in excellent condition and have accelerated a vigorous new growth. Growers generally feel confident that the season will produce an abundant crop of the highest quality fruit.

Spring fertilization is about completed and spraying operations are going forward full blast, showing a determination on the part of growers to give nature their utmost cooperation.

Quality fruit always commands a premium in the consumer market—which should be sufficient incentive to the grower to produce quality fruit.

Seeking an extension of fruit inspection to April 15, to guard against shipment of any late bloom Valencia before fully mature, is evidence that the industry is alive to its best interests.

A drive through the citrus growing sections of Florida at this season is a delight to the eye, incense to the nostrils. Seldom have Florida citrus groves presented a more attractive appearance or held greater promise of an abundant harvest of quality fruit. Groves have responded nobly to favorable winter weather and abundant spring rains.

Citrus Fruit Products Research

M. K. VELDHUIS

At Meeting of Florida State Horticultural Society.

(Concluded from last issue)

The Florida Citrus Commission Research Fellows have been investigating the production of concentrated citrus juices and have developed some very interesting products. During the past season equipment has been installed which permits concentration under a wide range of conditions. Concentration under vacuum at temperatures as low as 450° F. is now possible in a reasonable length of time. Samples of Pineapple and Seedling oranges have been prepared under vacuum at temperatures ranging from 450° to 120° F. and these are to be compared with samples prepared from the Valencia variety. These samples have been placed in storage at various temperatures and observations made of the effect on the quality of the concentrates. Bacteriological studies on the juice during concentration and during storage are included.

In addition to the regular concentrates just mentioned the Citrus Commission Research Fellows have been working on some special concentrates with very good possibilities. Concentrated orange juice made by the usual vacuum concentration process is practically devoid of the aroma so characteristic of fresh juice. These aromatic fractions are naturally removed during the vacuum concentration processes along with the water vapor. It has been found that by adding some fresh juice to the concentrate that a product is obtained of medium concentration which can readily be reconstituted to make a juice which is difficult to distinguish from fresh juice. Some of the lots have been prepared by diluting concentrates of about 60 degrees Brix to 420 degrees Brix, but other combinations may be used. It is felt that this concentrate will retain its flavor for considerable lengths of time if stored in a frozen condition at 0° F., but tests are being made to de-

(Continued on next page)



Delmo-Z

REG. U.S. PAT. OFF.

It helps to correct nutrition deficiency and to maintain plant vigor. The neutral zinc content is readily assimilated. Trees thrive, fruit flourishes.

Ortho

COPPER FUNGICIDE

REG. U.S. PAT. OFF. "53"

Melanose of citrus fruits is treated by this insoluble copper fungicide. Compatible with wettable sulfur. No undue scale problem because of minimum spray residue.

Vigorous trees are less susceptible to fungus attack. Delmo-Z supplies zinc — an essential element to vigor in the citrus grove. Ortho Copper Fungicide "53" supplements the effect of Delmo-Z, by protecting the fruit against melanose attack.

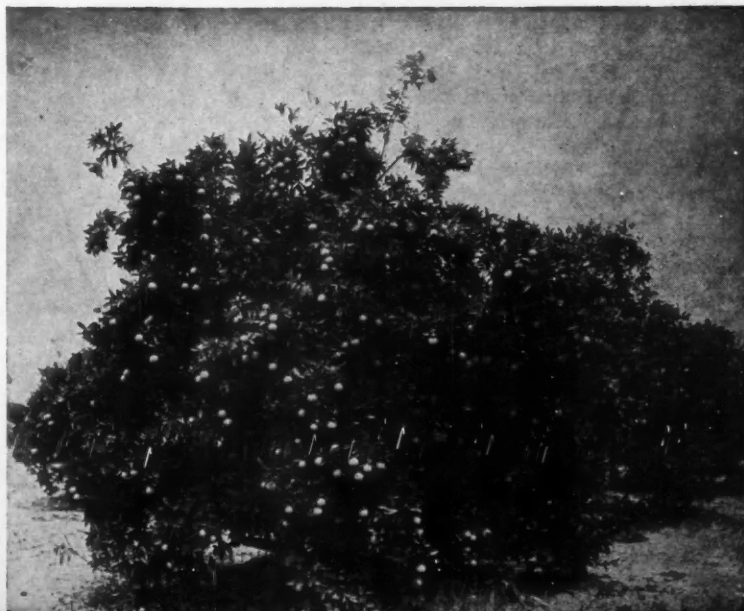
These two ORTHO products have proved highly effective under local conditions.



You'll find the practical assistance of your ORTHO fieldman valuable to you.

California Spray-Chemical Corporation

Orlando, Florida



CITRUS FRUIT PRODUCTS RESEARCH

(Continued from preceding page)

termine this as well as the storage life at 35° F. and higher temperatures. If stored in a frozen condition it can be used directly to prepare juice simply by adding the required amount of tap water. The water will melt the concentrate, the water will be cooled, and a cool drink obtained. This should appeal particularly to restaurant and soda fountain proprietors since the product can be dispensed rapidly without going to the trouble of squeezing fresh fruit. Application is being made for a public service patent covering the process so that it will be available to all without charge.

Peel Oil. Standards have been established by the Office of Marketing Service for the amount of recoverable oil in citrus juices. These standards have been established on the grounds that excessive amounts of peel oil impair the flavor of the juice and favor the development of terpene flavors during storage. Difficulty has been experienced by some workers in obtaining consistent results. A considerable amount of time has been spent by the Bureau of Agricultural and Industrial Chemistry checking the Clevenger apparatus now in general use and devising new apparatus. The present apparatus will give satisfactory results if proper precautions are taken, but if the operator is careless or in a hurry there is danger of loss of some of the oil and low results will be obtained. Plant operators naturally want results quickly on the juice going through their plants. In order to speed the determination an extra amount of heat is often applied in bringing the juice to a boil and if care is not taken to reduce the heat as boiling starts there will be a loss of oil from the top of the condenser since a large portion of the oil distills during the first minute or so.

It is believed that the method can be made more fool-proof and more rapid by substituting a conventional Liebig or a West-type condenser for the cold finger type now in use and that the hot vapors should enter the top of the condenser instead of the bottom so the hot steam does not come in contact with the oil layer in the trap and constantly redistill it. Apparatus for carrying this out has been devised.

Fatty Material in Citrus Juices.

In 1940 A. J. Nolte and H. W. von Loesecke (8) published some work on the petroleum ether-soluble material in orange juice. They obtained evidence indicating that at least a portion of the off-flavors which develop in canned orange juice was due to oxidation of the fatty material in the juice. This work has

been of much interest and an effort is being made to expand it and put it on a more quantitative basis. A new method of separating the oils has been developed which will be of considerable value. It consists of removing these materials from the juice by filtration and then extracting them from the residue with

TRENDS IN COSTS AND RETURNS OF FLORIDA CITRUS

(Continued from Page 7)

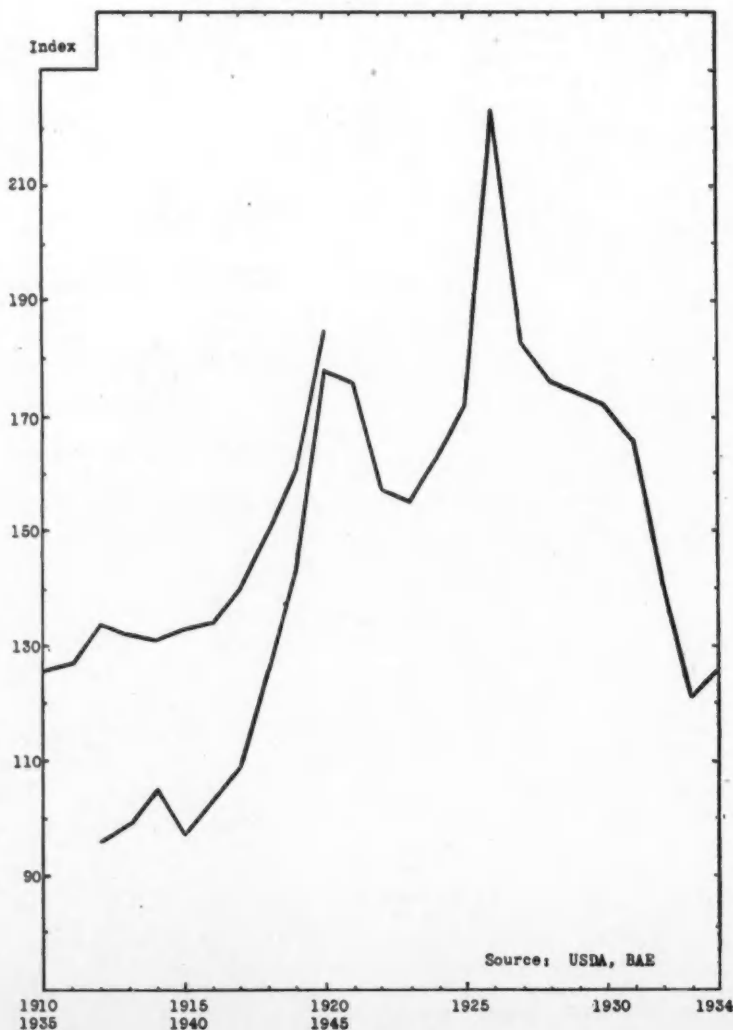
The average income from these groves during the past three years has been much higher and would have carried a 20-year loan of \$500 per acre and a production loan of \$100 and at the same time supplied

\$4,612 to the owner for his living. But this high income is not expected to continue indefinitely. Therefore it behooves every grove owner to reduce debts as fast as possible while income is high and be very careful about increasing his debts at this time.

(SEE CHART V ON PAGE 13)

CHART IV

FLORIDA FARM REAL ESTATE VALUES
INDEX NUMBERS (1912-14 = 100)



solvents. The solvent is evaporated and the material is then available for further study. This method removes practically all the fatty material and is more quantitative than the centrifuging method used previously. This procedure is to be used in a study of the fate of the fatty constituents in citrus juice and in devising means of controlling the amounts present.

Bacteriological Studies. During the past year bacteriological studies have been expanded. A considerable number of bacteriological counts were made in typical citrus juice plants during operation in order to obtain information on the types and numbers of organisms present in the various steps of processing. Isolations were made of typical organisms and samples of juice were prepared and bottled with varying numbers of these organisms present before pasteurization. Samples of these juices were examined after storage, and even though the organisms were killed during pasteurization some indications were obtained that they can adversely affect the flavor of the finished product.

The disposal of citrus waste liquors is still a serious problem and ways and means of utilizing as well as disposing of them are urgently needed. Efforts are being made to find other organisms that will utilize these wastes more completely and produce useful products.

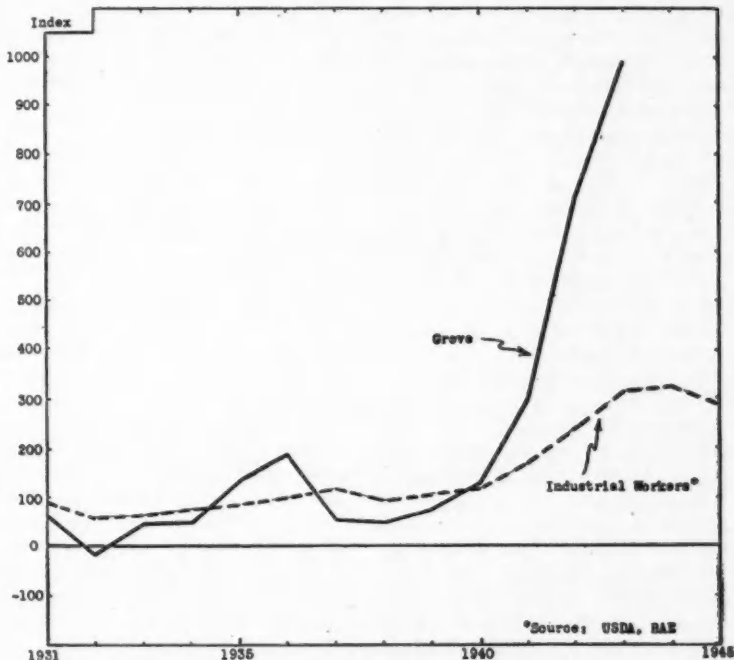
It is a pleasure to note that two processes which have been suggested by the U. S. Citrus Products Station have come into commercial use during the past year. These are production of feed yeast from waste liquors from citrus processing plants and the manufacture of alcohol from the citrus-waste press juice. It is believed that these developments are very significant and it is hoped that there will be more developments along these lines. It is believed that the possibilities of producing feed yeast of high protein and vitamin contents are particularly good.

Tangerine Products. The article published last year on "Tangerine Juice Products" (1) covering work by the Florida Citrus Commission Research Fellows has attracted wide attention particularly by the bottlers of carbonated beverages. Many inquiries have been received asking for information on the nature of the sirup and beverage bases prepared, samples and possible sources of supply. There appears to be a

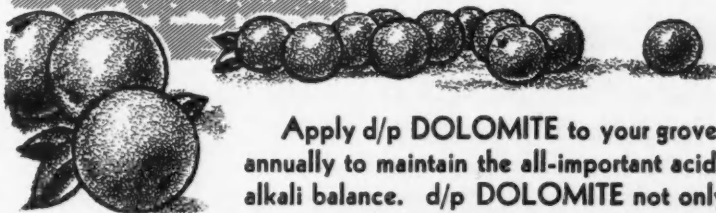
CHART V

OPERATING INCOME PER GROVE (FLORIDA)
AND
INCOME OF INDUSTRIAL WORKERS UNITED STATES

INDEX NUMBERS (1935-39 = 100)



DOLOMITE-Sweetened Soil Yields Sweeter Fruit ... and Sweeter Profits!



Apply d/p DOLOMITE to your groves annually to maintain the all-important acid-alkali balance. d/p DOLOMITE not only sweetens the soil by correcting excess acidity but also supplies the essential calcium and magnesium that are vital for tree health and production of high quality fruit of exceptionally good flavor. Apply d/p DOLOMITE now to sweeten your soil and Your 1946 Profits.



market here for at least a portion of the tangerine crop.

Powdered Citrus Juice. Some work has been done by the Florida Citrus Commission Research Fellows on the production of powdered citrus juice with the vacuum-drum drier. No entirely satisfactory product has been obtained, but several were prepared that have some interesting possibilities and leads have been obtained which will be useful in further work.

Flavor Recovery. The Eastern Regional Research Laboratory of this Bureau has had remarkable success in designing equipment for use in the preparation of concentrated apple flavor. Concentrations of the flavor as high as 150-fold have been made and these have proven to be very useful in restoring the flavor to apple concentrates. Considerable interest has been shown in this process and it appeared possible that it would have some application to citrus juices. Arrangements were made to have the equipment sent to Winter Haven, Florida. Several runs were made and no difficulty was experienced in obtaining 100 and 200-fold concentrations of the water soluble essences. It is believed that the process has possibilities of application to both single strength and concentrated juices.

Recent Publications. A number of publications have been issued by the Citrus Products Station during the past year. An article entitled "Changes Occurring in Orange and Grapefruit Juices During Commercial Processing and Subsequent Storage of the Glass-and Tin-Packed Products" by E. L. Moore, E. Wiederhold, and C. D. Atkins (6) discusses the relative merits of glass and tin containers. Both types of containers are satisfactory, but the storage life is generally a little longer in tin than in glass.

The article, "Recovery of Flavoring Oil from Persian Limes—Preliminary Experiments," by C. D. Atkins, E. Wiederhold, and J. L. Heid (2) gives approximate yields and information on the characteristics of Persian lime oil.

The survey work on the retention of ascorbic acid has been completed and the second article entitled "Ascorbic Acid Retention in Florida Grapefruit Juices. II During Storage of the Canned Product", by E. L. Moore, E. Wiederhold, and C. D. Atkins (7) has been published. The average retention of ascorbic acid was approximately 95 percent for

two months, 90 percent for four months, and 83 percent for six months storage at the prevailing room temperature. Their previous paper has shown an average retention of 97 percent of the ascorbic acid during the juice canning operations. These results are very important since they show that substantial amounts of this vitamin are retained in the juice during processing and storage.

An article, "Papaya Products", by J. L. Heid and A. L. Curl (4), based on previous work, gives considerable information on the preparation of a number of papaya products.

A paper entitled "Comparison of Methods for the Determination of Moisture in Dehydrated Vegetables" by A. L. Curl (3) appeared during the year. It presents comparative information on vacuum oven, benzene distillation, and toluene methods for determining moisture.

An article entitled "The Citrus Canning Waste Disposal Problem in Florida", by R. S. Ingols (5) gives a general review of the waste disposal situation and suggests solutions to some of the problems encountered.

It is believed that the U. S. Citrus Products Station at Winter Haven, Florida, has made substantial contributions to the knowledge of citrus products during the past year and it is hoped that even more valuable information will be obtained in the future.

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2. Atkins, C. D., Wiederhold, E., and Heid, J. L., "The recovery of flavoring oil from Persian limes—preliminary experiments", Fruit Products Journal 23, No. 10, 306-8 (1944).
3. Curl, A. L., "Comparison of methods for the determination of moisture in dehydrated vegetables", The Canner 98, No. 23, 22-25 (May 6, 1944).
4. Heid, J. L. and Curl, A. L., "Papaya Products", Fruit Products Journal 24, No. 2, 41-44, 53 (1944).
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7. Moore, E. L., Wiederhold, E., and Atkins, C. D., "Ascorbic acid retention in Florida grapefruit juices. II During storage of the canned products." The Canner 100, No. 8, 55-57 (January 20, 1945).

8. Nolte, A. J., and von Loebbecke, H. W., "Chemical and physical characteristics of the petroleum and other soluble material of fresh and canned Florida Valencia orange juice", Food Research 5, 457-467 (1940).

WORLD, NATIONAL AND STATE CITRUS PRODUCTION SETS ALL TIME RECORD

(Continued from Page 3)

placed at 14,100,000 boxes, compared with 12,633,000 last season and with 11,339,000 for the 10-year average.

The Florida crop of limes was estimated at 200,000 compared with 250,000 last season and with 93,000 for the 10-year average.

The department said Florida weather during January was favorable for development of the current crop; that in Texas, weather conditions were generally favorable but a hard wind early in the month caused some damage; in California January conditions were "generally unfavorable," and that cool weather in Arizona retarded the growth of Valencias and grapefruit.

Around 2½ million new and permanent jobs toward the goal of full employment in the United States can ultimately be created if the nation carries through an adequate nationwide forestry program says Forest Service Chief Lyle F. Watts in his 1945 annual report.

We Thank You...

Your patience during the trying period of the War is appreciated.

Resumption of Peace Time Service will come to you as rapidly as possible.

Florida Telephone Corporation

Serving 14 Counties in Florida
Headquarters: Leesburg, Fla.

SOME ADDITIONAL INFORMATION ON CITRUS PSOROSIS

(Continued from page 9)

in evidence. There were 129 Parson Brown trees in the planting that were carefully examined for psorosis leaf symptoms. Ninety nine of these trees showed definite leaf symptoms at that time. This was rather surprising and indicated that the budwood from grove A had come chiefly from psorosis infected trees.

Budwood for grove C was obtained from grove B in May, 1941 and placed in a variety of stocks. The Parson Brown trees, 293, were planted in grove form in September, 1942. These trees were examined for psorosis leaf symptoms in January, April, and June 1943. Two hundred sixteen of these trees showed typical leaf symptoms of psorosis up to that date. I think these results are ample evidence of the part psorosis infected budwood plays in the distribution of this disease.

Tests for Parent Trees

The parent trees or source of budwood should be the starting point. Such trees should be selected and tested for psorosis infection. However, I am inclined to doubt this and would not rely on that fact alone. Any parent tree that is to be the source of budwood, whether old or young, should be thoroughly tested for one season at least. Such a test is not difficult to make. A dozen buds taken at random over the tree can be selected and placed in young seedling plants that have not been previously budded. When growth from these buds appears it should be examined at weekly intervals for leaf symptoms of psorosis. Leaves from 1-2 to 3-4 developed will be more apt to show the infection. Each leaf should be carefully examined during the period of shoot growth. If any psorosis infected leaves appear in this growth the parent tree under test should be immediately discarded as a source of budwood. If the resulting growth from these buds shows no psorosis it is safe to assume that the tree is free from the disease. A second or third test in this same manner will make the case more certain. Such tests can be quickly made and definite results obtained in from 2 to 3 months after the buds are inserted, if growing conditions are good. In tests

with infected buds, definite leaf ed. symptoms have appeared on the growth from such buds in 6 to 8 weeks after the buds were insert-

Effect of Stocks on Psorosis
Psorosis infected buds have
(Continued on next page)



NACO

5 STAR BRANDS

★★★★★ These fine formulas team up with Nature to produce the finest fruit, truck and field crops.

★★★★★ Magnesium, manganese, copper, zinc, iron and borax, so vital for proper growth, quality and yield are all contained in these brands of NACO Fertilizers.

NACO FERTILIZER COMPANY

JACKSONVILLE 1
... FLORIDA

SOME ADDITIONAL INFORMATION ON CITRUS PSOROSIS

(Continued from preceding page)
been placed in the following seedling stocks: Sour orange, rough lemon, sweet orange, Cleopatra, grapefruit, Cuban shaddock, and Trifoliata. Infected Valencia buds were used, taken from a single tree with typical bark symptoms. The buds were allowed to grow, and

in the tops except, that leaf symptoms develop more profusely on vigorously growing shoots. The stocks that produce this type of growth apparently show a greater number of infected leaves and the markings are possibly a little more distinct than on shoots from slower growing stocks.

Stock Infection

Infection was soon carried from the infected buds into the stem

noted on all of these plants. New sprouts soon appeared from the cut stubs and typical leaf symptoms of psorosis appeared on this new growth. Several months later buds known to be free from psorosis were inserted in a number of these sprouts, and in every case the growth from these buds showed leaf symptoms of psorosis. This demonstrates that the virus is transmitted to the stock where it remains indefinitely and

Chart No. 1

| Grove A | Grove B | Grove C |
|--------------|----------|----------------------|
| Parent Grove | XXXXXXX | XXOXOX...XXOXIX. |
| Trees | XXOXXXX | XXO...XOOXOXIXIX. |
| 25 to | OXXXXXX | OXIXXOOOXIXXOXIXIX. |
| 50 years | XXOXXXX | OXOXOXOXOXIXIX...XX |
| old | OXIXXOXO | XXIXXOXOXO...XXOXIX |
| | XXXXOXO | OXOXOXOXIXIXXOXIXIX |
| | XXOXIXXO | XOXIXIXIXIXIXXOXIXIX |
| | OXIXIXIX | ...XXIXOXOXOXIXIXIX |
| | XXXXOXIX | XXXXOXIXIXOXOXIXIXIX |
| | OXOXIXIX | XXXXIXIXIXXOXOXIXIXO |
| | XXXXIXIX | XXXXXOOXIXO... .. |
| | XXXXOXIX | XXX...OXXOXIXIXIX |
| | OXIXOXIX | OOOXIXOXOXIXIXOO |
| | OXIXIXXO | XXXXOXIXIXIXIXO |
| | OXIXOXIX | ...IXIXXOXOXIX |
| | XXIXOXO | XXOOOX...XX |
| | OOIXXO | XXXXIXOXOXIX |
| | XXXXIX | XXXXOXOXIX |
| | X-IX | XXXXOXOXIX |
| | XOO | OXOOOXOXIX |
| | XX | XXXXIXIX |
| | O | ...IXIX |
| | | XXOXIX |
| | | XXX... |
| | | XXXXIXO |
| | | XXXXIXO |
| | | ...IX |
| | | OXIXIX |
| | | XXXXO |
| | | CCX |
| | | OOO |
| | | XX |
| | | XX |
| | | X |

X = trees showing psorosis leaf symptoms
O = apparently healthy trees. No leaf symptoms
... = a different variety of citrus

leaf symptoms occurred on practically all of the Valencia tops produced on these stocks, within a year after the buds were inserted.

The stocks used in this group seem to make little difference in the development of leaf symptoms

and root systems of the various stocks. Psorosis infected buds placed in various seedling stocks were cut off below the bud union about 15 months after the buds were inserted. Each bud had made a fair top growth, and leaf symptoms were

can be transmitted to any healthy buds placed in such stocks at a later date. This has been definitely established by budding experiments the past three seasons. It was also noted that infected buds frequently died before making shoot growth, al-

though such buds were green and apparently alive when the wraps were removed. It was later noted that psorosis symptoms appeared on the new growth putting out from such stocks or from twigs of larger trees several weeks after the buds had died. This raised the question of how soon the virus could be transmitted from an infected bud to the healthy seedling or twig in which it was inserted. An experiment was made to determine this point, and it was found that where the buds were removed after 72 hours 80 percent of these buds had transferred infections to the stocks in which they were placed.

In this experiment the buds were placed in a number of Valencia seedlings that had been kept under observation for psorosis for two seasons and remained free from any leaf symptoms. The stocks were about two years old and in a vigorous growing condition. The buds were taken from a Valencia tree showing typical bark symptoms, and the twigs from which the buds were cut bore leaves in which typical leaf symptoms had appeared. All buds were inserted in the stocks on the same date. A certain number of the buds were removed 24 hours after budding and the wounds rewrapped. Another set was removed 72 hours after budding, a third set at the end of seven days, a fourth set at the end of 14 days, and a fifth set after the buds had produced shoot growth and leaf symptoms were visible. In the sixth set the buds were left to make top growth of the plants.

No transfer of infection was noted from any of the buds removed 24 hours after insertion. Buds that were removed 72 hours after insertion transferred the infection to 80 percent of the plants budded. Buds removed after seven days had infected all plants, or 100 percent, and the same was true of the buds removed after 14 days and when young infected shoots were removed. In the set of buds that were retained as tops psorosis infections appeared in all these plants on young leaves from the bud growth and on young shoots that put out from the stocks.

These results indicate that a very short period of time is required for the virus to travel from infected buds to healthy stocks. If growth contact is made between the bud and stock the transfer of infection has been made regardless of what happens to that particular bud later. This contact may take place in 72 hours or even earlier, depending on growing

(Continued on page 20)



BALANCE

counts in Baseball. Big league ball players regain the coordination and timing lost because of winter inactivity through "spring training." Right now 12 major league teams are in Florida for this "balancing" program.

And NOW is the time, too, for Florida farms and groves to get their "spring training." Foresighted farmers and growers are making sure that their soils are in proper balance, that their crops are assured of getting all the essential plant foods necessary for abundant, profitable yields.

Gulf Fertilizers, for more than forty years, have been successful in restoring and maintaining balance in Florida soils. Exhaustive field tests have developed a Gulf Brand for your specialized needs. And there is a Gulf Field Man nearby to help you with your individual requirements. So, for assistance and advice in your agricultural planning, call on the Gulf Field representative in your territory. It is his job to help you plan your "spring training."

Yes, and season after season, you can boost the batting average of your crop production by using Gulf Fertilizers.

Reminder for this Month:

It isn't too early to start planning for your summer citrus application. Since supplies are generally scarce, we suggest taking delivery as early as possible.

GULF

FERTILIZER

THE GULF FERTILIZER COMPANY
Tampa And Port Everglades, Florida



The LYONIZER

Department

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Reports Of Our Field Men . . .

NORTH CENTRAL FLORIDA V. E. (Val) Bourland

We have a very nice rain about the 20th of February that made every grower in this territory feel very good. We are getting an exceptionally heavy orange bloom on our old wood and with these rains we should set a fine crop of fruit that will result in splendid quality this fall. Growers have been busy with their spray machines and will follow this through all during the year with a complete spray program. The watermelons acreage is heavy and from last reports that we had as we covered the territory we have every reason to believe that the crop would come in extremely early. Vegetable crops are doing nicely in this territory. There will be a large acreage of cukes planted and they are now coming up and looking fine. Valencias are just beginning to move to market in volume and prices are within a satisfactory range. We still have a considerable tonnage of late bloom on mid-season varieties to move to market.

SOUTHWEST FLORIDA Eaves Allison

The citrus bloom is very heavy and well along even the central west coast section. It has been my observation that most of these groves carrying a large crop of late bloom fruit are having a very heavy bloom again at this time, and this is relaxing to a great many growers that have been wondering about what effect the late bloom of last summer would have on the crop this spring. In the Ft. Myers section where we normally expect an early bloom, we find that it is retarded and there is very little bloom or growth at this writing—the middle of February—but it is quite dry in this section and this probably accounts for the lack of growth and bloom. Irrigation plants are in operation in spots over most of this territory and more would be called into action except for

the difficulty of obtaining pipe. Rust mite are still plentiful and a regular check should be made for this pest. Purple mite has caused considerable loss of leaves in some areas but seem to be on the decline at this time. There is a great deal of interest being shown by growers in mechanical fertilizer distributors at this time and wisely so as they do an exceptionally fine job of spreading all types of fertilizer.

HILLSBOROUGH & PINELLAS COUNTIES

C. S. (Charlie) Little

We were beginning to get very dry in this section prior to the rain during the latter part of February, but with the light rain that we had it now seems that we are going to set an unusually nice crop of exceptionally early bloom and that should result in one of the finest crops of quality fruit that we have had in a number of years. In this territory we have been very fortunate in the movement of our fruit and had there been no shortage of materials as a result of the strikes we would have had a large portion of available fruit either in the packing house or the cannery. However, we still have at this time a considerable tonnage of late bloom on early and mid-season varieties of fruit on the trees and while most of this will be moved through various canneries it is hoped that prices will remain at a good level and satisfactory profits will be received. Valencias are beginning to move to market and the prices are satisfactory. Packing houses are hopeful that beginning with the Valencia deal that they will be able to clean the trees instead of spot-picking as they have had to do with most early and mid-season varieties.

POLK COUNTY

J. M. (Jim) Sample

Every indication at this time is that we really will have "something special" to offer the

consuming public of citrus fruits during the coming season. We are getting an exceptionally nice crop of bloom set on all varieties of oranges and Marsh seedless grapefruit. Common grapefruit and tangerines are slow in blooming, but it is safe to believe that we will have a sufficient amount of this bloom to result in a normal crop. This bloom coming on old growth and early in the season coupled with favorable spraying weather, leads us to believe that we are going to have some real quality when the fall season gets under way. Growers throughout this section are either busy with their spray machines or will be getting them under way with a post bloom program that will be carried through in an effort to help nature in producing one of the finest crops of fruits for the coming season that Florida has ever offered to the market. There has been considerable activity by the growers in replacing all missing trees and in some instances new groves are being set.

WEST CENTRAL FLORIDA

E. A. (Mac) McCartney

I can't help but think of the farmer when he walked up to the pig sty and admired his fat pig these days as I look at the wonderful bloom that we are getting on most all varieties of citrus, and as the farmer, I have to exclaim: "Oh How Beautiful." Well, this bloom is a thing of beauty and as a pretty young girl, will develop into something that will make all of manhood proud of the association, however, just like girlhood developing into full maturity of womanhood, which can be something ugly and ungainly. Let us hope that through this season we will have a full season of plenty, and with no need for anything that would make us less, or our fruit poorer in quality than the full bloom of young womanhood. We are doing our parts as far as giving the trees a full share of well balanced fertilizer and most growers are supplementing this with the proper spray program that will not only have its effect at this time but will show in the quality of fruit to be harvested this fall and the growth made during the summer.

ADVERTISEMENT—LYONS FERTILIZER COMPANY



Been readin' a book lately and was much impressed by the following statement: "There are 336 millions of acres of arable land in this land of ours, which if divided would provide each of our 132 million people with 2.5 acres of land for growing food and fibre." If that means what we think it does we're mighty well fixed compared to a lot of countries we could name.

Agriculture is still the biggest industry in this country, but only 25 percent of the folks is occupied with that business, which tells quite a story when you stop to think that 90 percent of the folks was engaged in agriculture 150 years ago. Scientists and improved methods and machinery is lettin' the 25 percent now in the business of farmin' do what the 90 percent did a long time ago. And each new improvement usually cuts costs too, which is something every farmer had better consider.

'Nother thing is that farmers has learned that depleted soils in the United States can be restored by smart management and the use of proper plant foods. This is 'specially true in Florida where we can help nature along with our long growing seasons and where proper care can keep our soils producin' money crops the whole year 'round.

Some folks has been worryin' about runnin' out of plant foods, but that is a lot of boloney . . . they's 35,000 tons of nitrogen in the air over every acre of land, and enough rock phosphate deposits in Florida to last the nation for more'n a 1000 years, while the deposits in the Rockies are just now bein' tapped. They is more'n enough potash to last over a 100 years, while still greater foreign supplies are available if we need 'em. So there ain't no real reason to start worryin', in spite of the fact that from twelve to thirteen million tons of fertilizer is used each year to produce the food and fruit we need.

And the best thing of all is that fertilizer is one of the cheapest commodities the farmer buys. Right now fertilizer prices is just about half what they was in World War I. In 1944 fertilizer prices was only 20 percent higher than in 1910-14, while farmers was properly gettin' a hundred percent more for the crops they raised. Compare the price you pay for fertilizer with most other things you buy and you'll find by comparison that fertilizer is down-right cheap.

Competition has had somethin' to do with keepin' prices down. From 1927 to 1940 the net average income of manufacturers was only .95 percent, or less than one cent out of each dollar of gross sales, which sure is skatin' close.

Uncle Bill

SOME ADDITIONAL INFORMATION ON CITRUS PSOROSIS

(Continued from page 17)

conditions present in the stock and bud at the time. In the past few years we have repeated instances where infected buds were inserted in branches of bearing trees and in various seedling stocks and, even where these buds have died before making any good shoot growth, the infection has been transferred to the budded members and has appeared on the young foliage coming out later. This is one of the subtle means by which the disease might be transmitted and no doubt has been on many occasions in the past. Rebudding of nursery stock in which the buds have failed or died might be a dangerous practice unless you are absolutely certain of the history and condition of the buds that were first introduced. Buds from plants that are known to be free from psorosis do not transmit the disease and, when buds of this character are used and fall, rebudding of the stocks would be reasonably safe.

Is Psorosis Carried in Citrus Seeds?

This question is still unanswered, although investigations thus far would lead one to believe it is not generally distributed in this manner if at all. Several hundred seedling trees have been kept under close observation for the past four or five years and carefully examined for psorosis leaf symptoms at frequent intervals, and none of these seedlings have yet developed any leaf symptoms of the disease. These seedlings came from seeds taken from Valencia fruits that were borne on a tree severely affected with the bark symptoms of psorosis. This tree repeatedly showed leaf symptoms of the disease, and if the virus was contained in citrus seed, one would reasonably expect to find it in the seeds from a tree in this condition. Seeds were also collected from young Parson Brown trees that showed typical leaf symptoms of psorosis during the past two years. Not one single tree in this lot developed any visible symptoms of psorosis.

A number of the seedlings in the above lots of trees have been budded from time to time with psorosis infected buds, and with buds that were free from symptoms of psorosis. In every case where infected buds were introduced and bud growth resulted the plants developed typical psorosis in the young

leaves. Growth from healthy buds produced plants that were entirely free from psorosis and remained so.

If the disease is transmitted in the seeds it must be rarely so and perhaps only in certain varieties or strains of citrus. Further investigations should be made in this connection, especially on the seeds commonly used for citrus stock production. It is hardly probable that the seeds play any important part in the distribution of psorosis.

Is Psorosis Carried on Tools?

Is psorosis spread by budding implements or tools used in the handling of nursery stock? This question has been frequently asked, and we have sought to find the answer. Apparently it is not. Pruning shears and the budding knife would be the most likely agents, if the disease could be spread in this manner. Several attempts have been made to transmit psorosis by these implements but all efforts have been unsuccessful. In one experiment healthy Valencia seedlings have been severely cut back with pruning shears that were thoroughly sterilized before the operation was started. An equal number of healthy seedlings were cut back at the same time by pruning shears that were first cut through psorosis infected twigs before each plant was pruned. The new growth appearing on these plants has been inspected for a period of about two years, and none showed symptoms of psorosis.

In other tests on healthy seedling plants the budding knife was used. The knife was first cut into the bark of an infected budstock or shoot, and immediately used to make a slit in the bark of the seedling as if to insert a bud. In some cases the inner bark and sap were scraped from infected twigs and inserted in these slits. The slits were then wrapped with budding tape for days. A similar number of healthy seedlings were treated in the same manner, using a sterilized knife to be sure no contamination was introduced. Those were to serve as checks. The new growth has been closely inspected on these plants during the past two years, and no psorosis has yet appeared from these operations. It is hardly probably that the disease is spread by any implement used in the nursery or field and that the pruning saw or shears are not agents to spread the disease from one tree to another.

If the theory is true that psorosis is only transmitted when contact growth takes place between infected and healthy citrus tissue, and this seems to hold true, then the disease is only distributed by means of infected budwood or infected trees.

No natural carriers of the disease are yet known. However, the disease may spread in the older bearing groves where the root systems become entwined and natural grafting of the larger roots takes place. This is probably a minor method of dis-

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tribution and slow in progress.

Effect of Psorosis on Yield

There is very little information available as to the effect of psorosis on yield or the annual loss in fruit from infected trees in Florida. It would be difficult to estimate this loss, except in severe cases of the disease, because we find such a variation in the apparent vigor and condition of trees carrying psorosis in the early years of their development. It is probable that in the first few years of bearing when only leaf symptoms are present the effect on yield is comparatively small. As the tree advances in age and bark symptoms appear, decline sets in, and it is then that reduction in yield becomes more evident, and it is probably proportional to the amount of decline. What this loss amounts to over a period of years or during the life of an infected grove is unknown.

A citrus psorosis survey has been made in California by the Citrus Experiment Station, under the direction of Dr. Fawcett. The results of this have been recently reported by Joseph S. Tidd (4) and furnishes some interesting information. The survey was made in Navel and Valencia orange groves in which both healthy and infected trees were located. Only trees showing bark symptoms were considered as psorosis infected. An estimate was made of the number of boxes of fruit on each diseased tree in the grove and also an estimate of the number of boxes on the adjacent healthy trees. The Navel trees surveyed ranged from 35 to 50 years of age and the Valencia trees from 25 to 30 years. It was found that the amount of fruit produced by a psorosis infected tree averaged about two-thirds of that produced by a normal, healthy tree in the same age and variety group.

Control

I think we can safely assume that psorosis infected budwood is the principal source of spreading the disease today, and if the source of budwood can be controlled we can soon prevent the further spread of this trouble to new plantings. This will not eliminate the psorosis infected trees in our groves at the present time, and there is very little hope for a practical method of control or cure where the disease is systemic that is, where the virus has spread throughout the tree. This condition is usually manifest in older trees that show bark symptoms and general decline and in young nursery plants resulting from infected buds.

The logical and most practical method of controlling the spread of psorosis depends on the production of nursery trees free from the disease. This, I think, can be done without too great expense or trouble on the part of both large and small nurseries throughout the State.

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